Review 4 Rules of Differentiation

1. $\frac{d}{dx}(x^n) = nx^{n-1}$
2. $\frac{d}{dx} k \cdot f(x) = k \cdot f'(x)$
3. $\frac{d}{dx}(c) = 0$
4. $\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

Mar 5-7:24 AM

$$\frac{d}{dx}[8x^3 - 3x^2 + 7x + 4] = 24x^2 - 6x + 7$$

$$\frac{d}{dx}(\sin x) = \cos x$$
$$\frac{d}{dx}(\cos x) = -\sin x$$
$$\frac{d}{dx}(\tan x) = \sec^2 x$$
$$\frac{d}{dx}(\cot x) = -\csc^2 x$$
$$\frac{d}{dx}(\sec x) = \sec x \tan x$$
$$\frac{d}{dx}(\csc x) = -\csc x \cot x$$

Mar 5-7:43 AM

$$\frac{d}{dx}[f(x) \cdot g(x)] = f(x)\, g'(x) + g(x)\, f'(x)$$
$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\, f'(x) - f(x)\, g'(x)}{[g(x)]^2}$$
$$\frac{d}{dx}\left[\frac{x^2 \sin x}{2x+1}\right] = \frac{(2x+1)(x^2\cos x + \sin x \cdot 2x) - x^2 \sin x \cdot 2}{(2x+1)^2}$$

Mar 5-7:51 AM

$$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}(\cos^{-1} x) = \frac{-1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}(\tan^{-1} x) = \frac{1}{x^2+1}$$
$$\frac{d}{dx}(\cot^{-1} x) = \frac{-1}{x^2+1}$$
$$\frac{d}{dx}(\sec^{-1} x) = \frac{1}{|x|\sqrt{x^2-1}}$$
$$\frac{d}{dx}(\csc^{-1} x) = \frac{-1}{|x|\sqrt{x^2-1}}$$

Mar 5-7:58 AM

$$\frac{d}{dx}(e^x) = e^x$$
$$\frac{d}{dx}(a^x) = a^x \ln a$$
$$\frac{d}{dx}(2^{x^3+3x}) = 2^{x^3+3x} \cdot \ln 2 \cdot (3x^2+3)$$
$$\frac{d}{dx}(\ln x) = \frac{1}{x}$$
$$\frac{d}{dx}(\log_a x) = \frac{1}{x \ln a}$$

Mar 5-8:03 AM

$$\frac{d}{dx} f(g(x)) = g'(x) \cdot f'(g(x))$$
$$\frac{d}{dx}(3^{\sin x}) = 3^{\sin x} \cdot \ln 3 \cdot \cos x$$
$$\frac{d}{dx} \tan\sqrt{2x+1} = 2 \cdot \tfrac{1}{2}(2x+1)^{-\frac{1}{2}} \cdot \sec^2\sqrt{2x+1}$$

| x | f(x) | g(x) | f'(x) | g'(x) |
|---|---|---|---|---|
| 2 | 8 | 3 | 1/3 | -3 |
| 3 | 3 | -4 | 2π | 5 |

$$\frac{d}{dx}[f(g(x))]\Big|_{x=2} = g'(x)\, f'(g(x))\Big|_{x=2}$$
$$= g'(2)\, f'(g(2))$$
$$= (-3) f'(3) = -3 \cdot 2\pi$$
$$= -6\pi$$

Mar 5-8:08 AM

If $f(x)$ and $g(x)$ are inverses

then $f'(x) = \frac{1}{g'(f(x))} = \frac{1}{g'(y)}$

Mar 5-8:21 AM